BlueSource

a leading climate change portfolio and CCS developer

Anthropogenic CO_2 in CCS with EOR: Project Experience & Lessons Learned

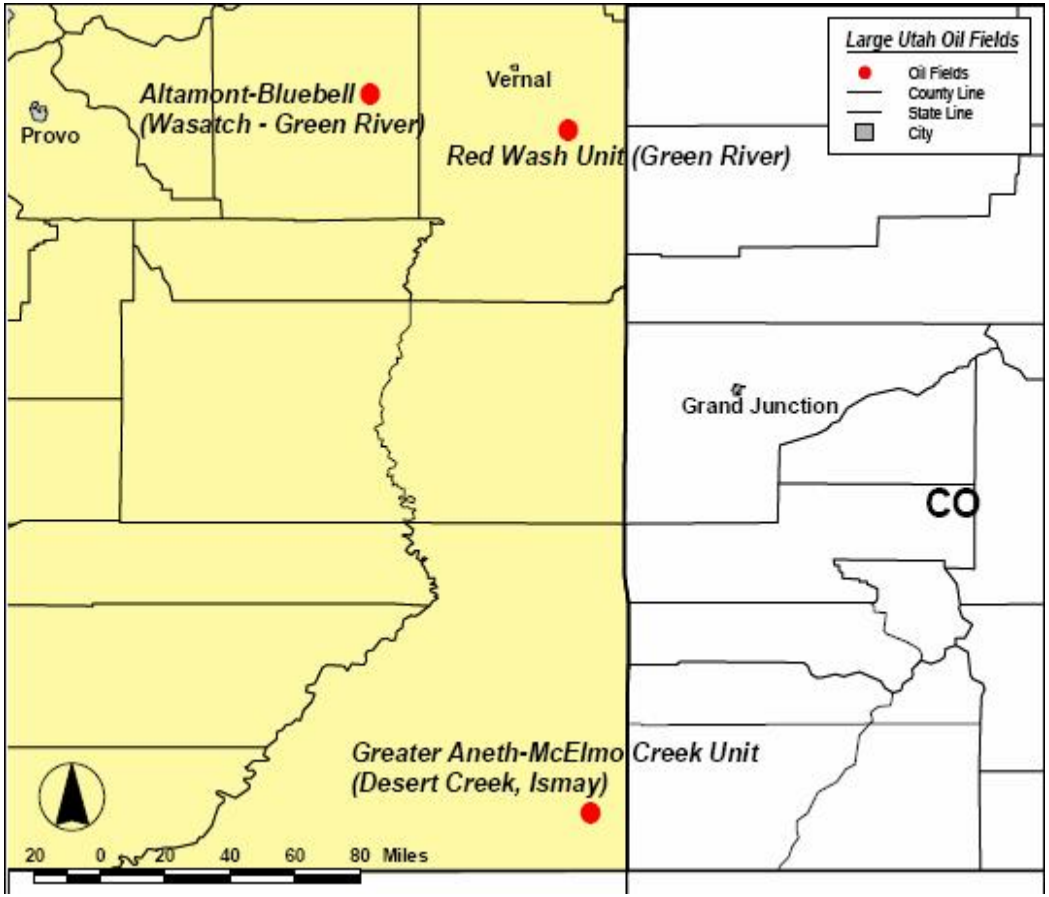
Utah Ghg Working Group
Salt Lake City, Utah
May 8, 2007

For the next 20 mins…

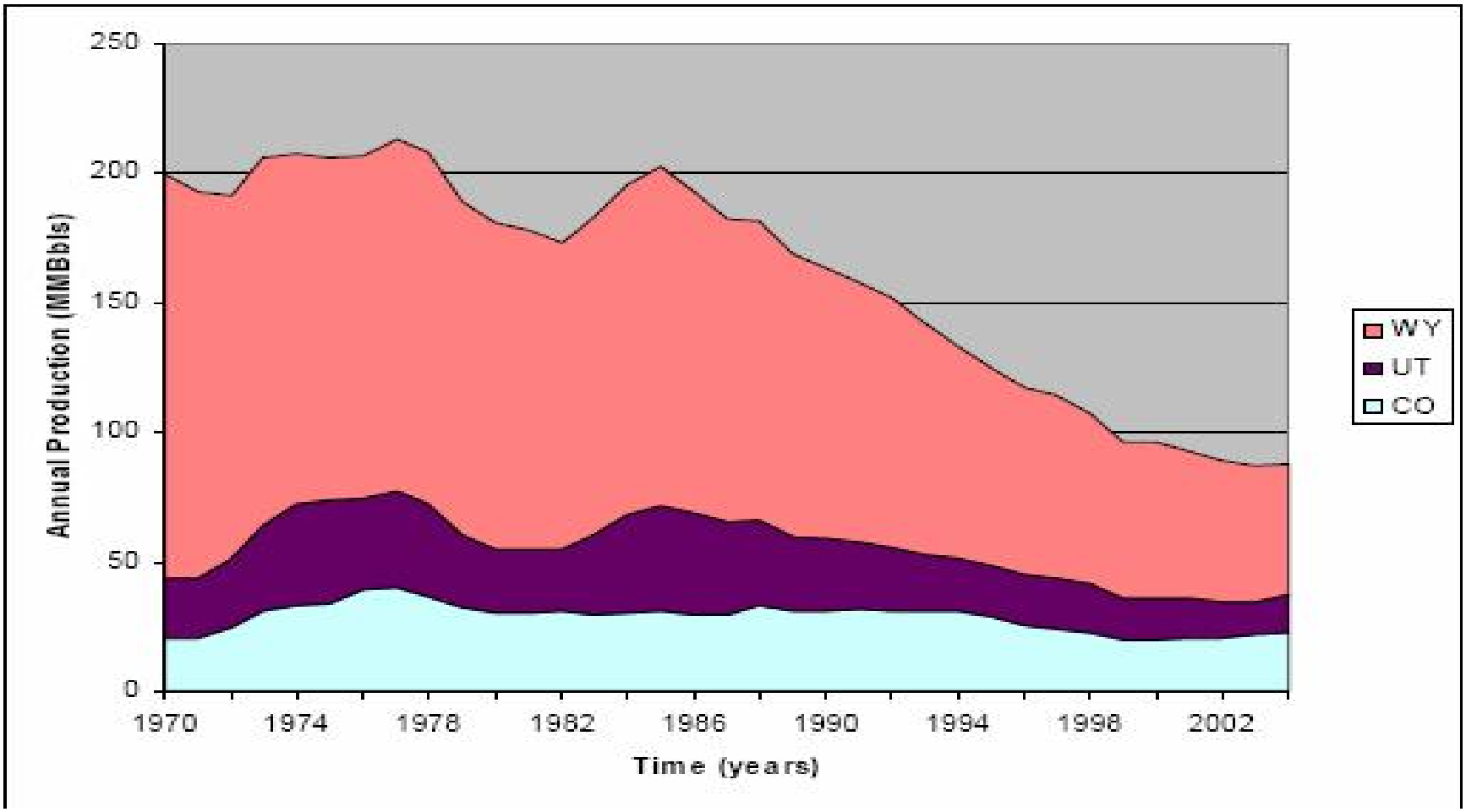
- Why CCS with EOR in Utah?
- Sharing experience and lessons learned.
- Sharing the process of CCS with EOR project development.

Utah CCS in EOR Potential – How Big?

- Target: 740 million barrels ($30B)
- Potential CO_2 in EOR storage capacity of
  - 200 million tonnes
  - 3.5 TCF or 0.3 BCFD for 30 years
  - Approx. 1000 MWs of coal-sourced power generation
- CO_2 Sourcing Logistics
- Export/Import CO_2 Race



Decline in Rocky Mountain Production



Potential Utah EOR Floods - Advanced

Utah	ALATAMONT-BLUEBELL	WASATCH AND GREEN RIVER
Utah	ASHLEY VALLEY	PHOSPHORIA-WEBER
Utah	GREATER ANETH-ANETH UNIT	DESERT CREEK/ISMAY*
Utah	GREATER ANETH-MCELMO CREEK UNIT	DESERT CREEK/ISMAY
Utah	GREATER ANETH - RATHERFORD UNIT	DESERT CREEK/ISMAY
Utah	GREATER ANETH - WHITE MESA UNIT	DESERT CREEK/ISMAY
Utah	LISBON	MADISON - REDWALL
Utah	MONUMENT BUTTE	GREEN RIVER
Utah	PINEVIEW	NUGGET SANDSTONE
Utah	PINEVIEW	TWIN CREEK
Utah	RED WASH UNIT	GREEN RIVER
Utah	UPPER VALLEY UNIT	KAIBAB
Utah	WALKER HOLLOW	GREEN RIVER
Utah	WONSITS VALLEY	GREEN RIVER

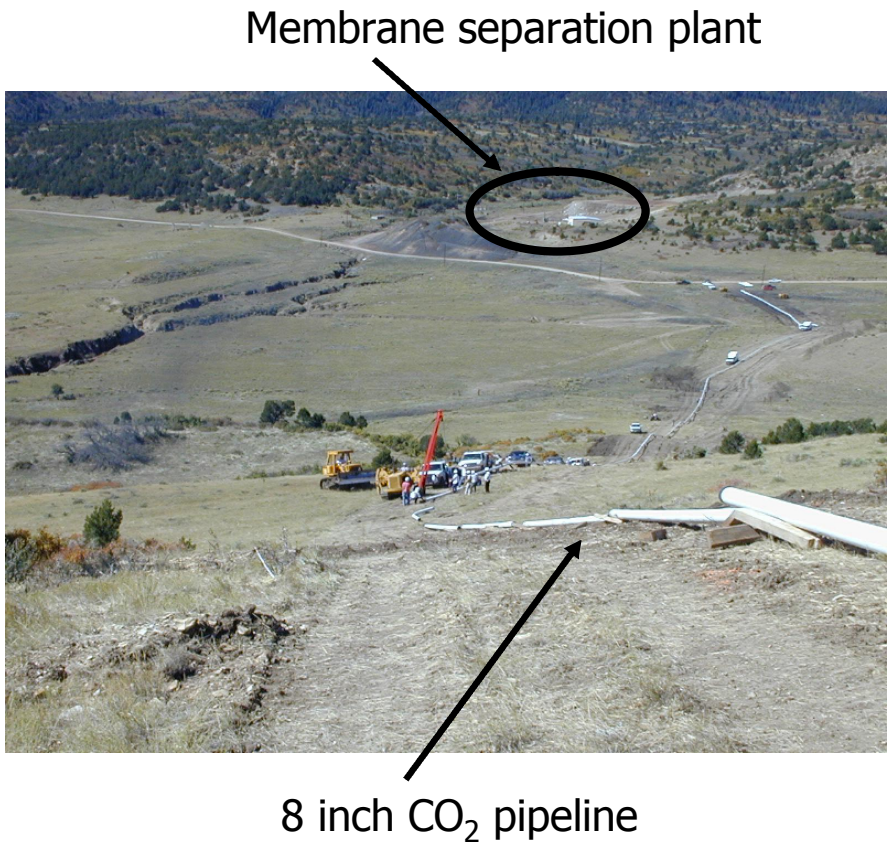
Blue Source Experience and Lessons Learned

Blue Source CO_2A in EOR Experience

- CO_2A in EOR Project Management Experience
  - Concepted and constructed (Val Verde CO_2 PL, North Cross CO_2 PL, Anadarko's Wyoming CO_2 PL, Weyburn CO_2 PL)
  - La Veta CO_2 PL – 2nd Qtr 2007
    - 16 miles-8 inch, initially 35 MMCFD, ~500k VERS per annum
  - Developing projects (West Texas, South Texas, Wyoming, Kansas and Louisiana)
- Carbon Reduction Creation and Trading Experience
  - Sold and delivered approx. 10 million tonnes of ghg VERs from geologic sequestration
  - Sourcing approx. 700 MMCFD of geo-seq CO_2A injection

CCS Example: La Veta Project

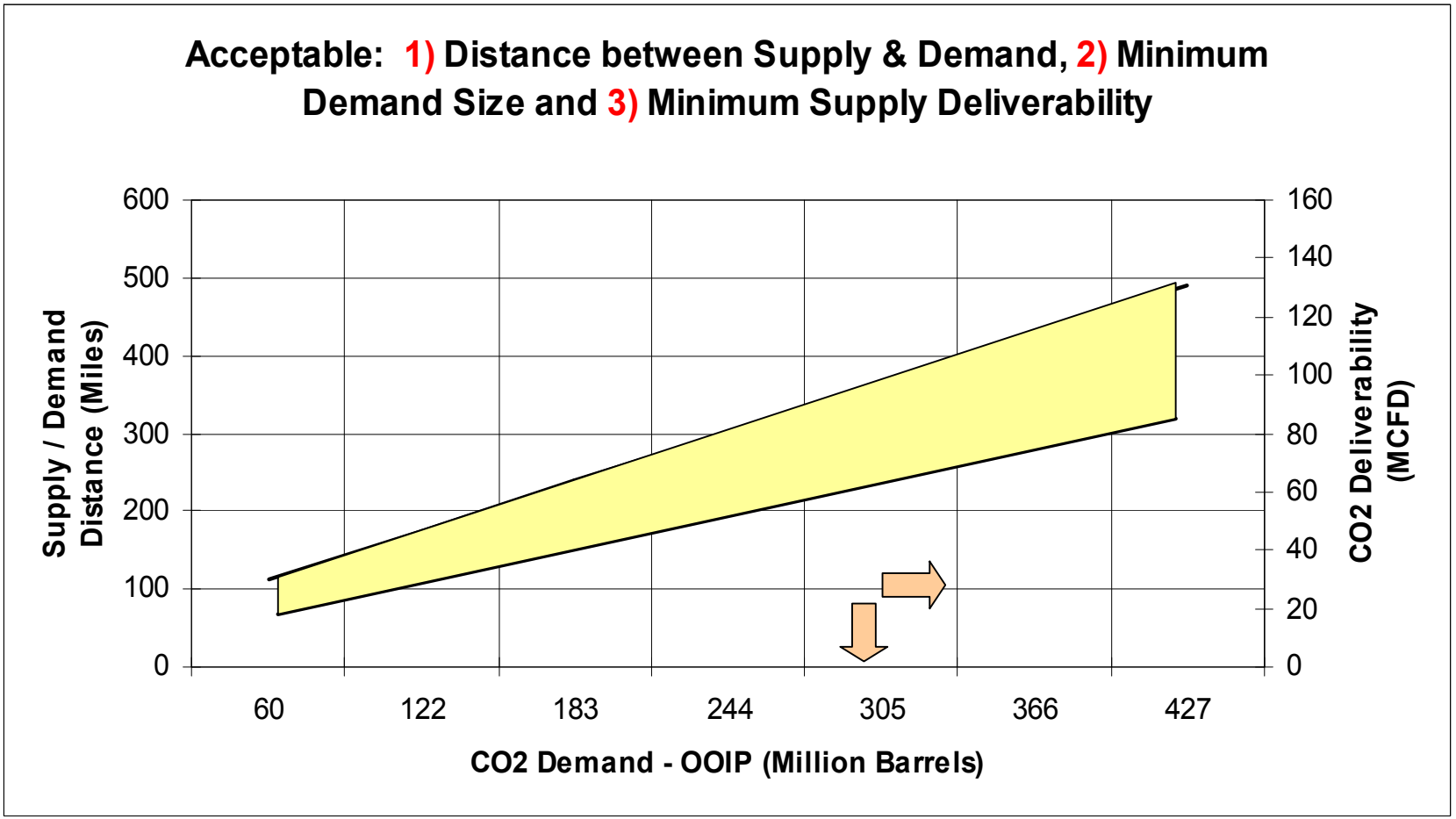
- Dual source, dual compression, dual storage
- Membrane separation
- 25 MMCFD anthropogenic, 10 MMFD geologic CO_2
- $38 million ($6.5 million in CO_2 investment)
- CO_2 CCS in June 2007
- 500k tonnes/yr of ghg VERs
- 8”, 16 mile CO_2 pipeline
- Project growth
  - 600 BCF CO_2 (37 million tonnes VERs reductions)



Lessons Learned in Vent Stack CO_2 Connections

- Val Verde Project
  - Buying vent stack CO_2
    - Economics, interruptability, quality, types of proration
  - Aggregating multiple CO_2 sources
    - Proration of takes based on economic conditions of CO_2 source, quality
    - Balancing and banking
  - CO_2 balancing agreements
    - Managing interruptability
      - Banking
      - Secondary storage
    - Should be a low cost, no cost
- North Cross Project
  - Initial screening models for vent stack sources
    - Fundamentals: OOIP, distance, CO_2 deliverability
    - Accuracy of model tested against actual projects
    - Variables: line size, thru-put, pressure – origin/termination, steel prices, construction costs, ROW costs, CO_2 costs, compression investments and opex, two forms of CO_2 separation, CO_2 dehy investment and opex, OOIP, CO_2 deliverability & reserves, ghg VER costs & revenues

Screening a Project's Viability



EOR Project Screening

Key Assumptions Input

PROJECT SCREENING - THEORETICAL FLOOD ANALYSIS

RESERVOIR DATA INPUT

Current Oil Rate	2500	stb/d
Current Oil Cut	0.027	fraction
Decline Rate	0.120	fraction/year
Existing Injectors	40	
New Injectors	0	
Existing Producers	47	
New Producers	0	
TA'd Producers	0	
Average Depth	5000	ft
Pattern Size	11.80	acres/pattern
Average Net Pay	210	ft
Average Porosity	0.099	fraction
Initial So	0.800	fraction
Bo(initial)	1.30	rb/stb
Bo(current)	1.25	rb/stb
BCO2	0.45	rb/mcf
Water Inj Rate	600	bw/d/pattern
Injection Losses	0.00	fraction lost

INPUT FOR CASH FLOW CALCULATION

Royalty	0.125	fraction
Oil Price	14.00	$/bo
Increase	0.02	fraction/year
CO2 Price	0.55	$/mcf (flat nominal)
Inflation	0.02	frac per year
Recycle Cost	0.20	$/mcf
Lift Cost	0.10	$/bbl
Fixed Cost	0	m$/month
Discount Rate	0.10	fraction/year
Fed Tax Rate	0.35	fraction
EOR Tax Credit	0.15	fraction
SevTax Relief	0.023	fraction (half of Texas rate)

INPUT FOR CAPITAL INVESTMENT CALCULATION

CO2 Source	0.50	miles	(Distance from major CO2 pipeline)

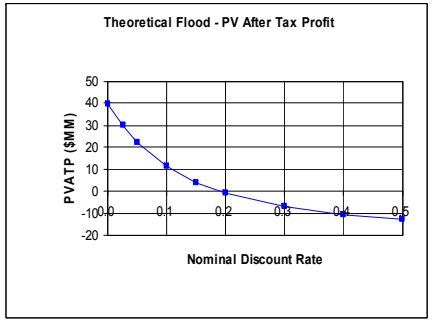
OUTPUT

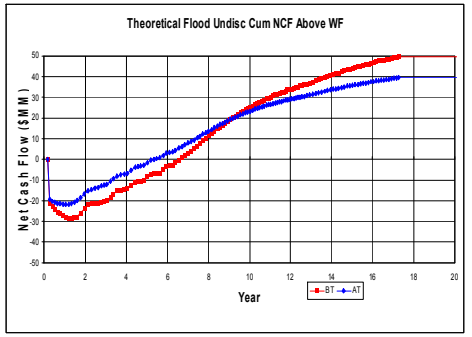
Total CO2 Injected	98	bcf
	0.72	
CO2 Purchased	46	bcf
EOR Recovery	8.1	mmstb
	0.17	frac OOIP
Net CO2 Utilization	5.7	mcf/stb
Nominal Injectivity	0.144	hcpv/yr
Effective Injectivity	0.144	hcpv/yr
HCPV	1522526	rb/pattern
OOIP	1171174	stb/pattern
Initial Investment	5.9	mm$
Recycle Investment	13.4	mm$
Total Investment	19.2	mm$
PVPAT (at 10% nominal discount)	11.5	mm$

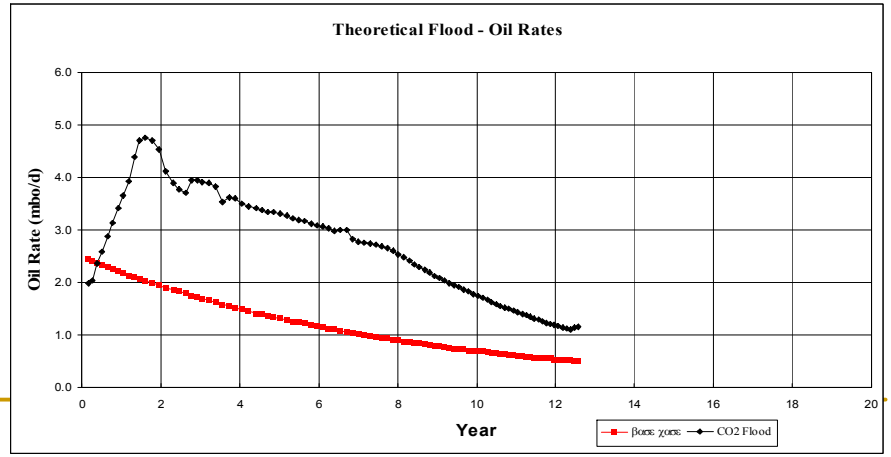
CAPITAL INVESTMENT CALCULATIONS

Max CO2 Purchased	64	mmcf/d
Max Gas Produced	29	mmcf/d
Recycle Capital	1252	$/mmcf
Well Spacing	5	acres/well
Total Injectors	40	
Total Producers	47	
Injector Capital	0.02	mm$/injector
Producer Capital	0.01	mm$/producer
Trunk Line	0.3	mm$
Drilling Costs	0.0	mm$
Wells	4.3	mm$
Surface Facility	1.4	mm$
Recycle System	13.4	mm$
Other	0.0	mm$

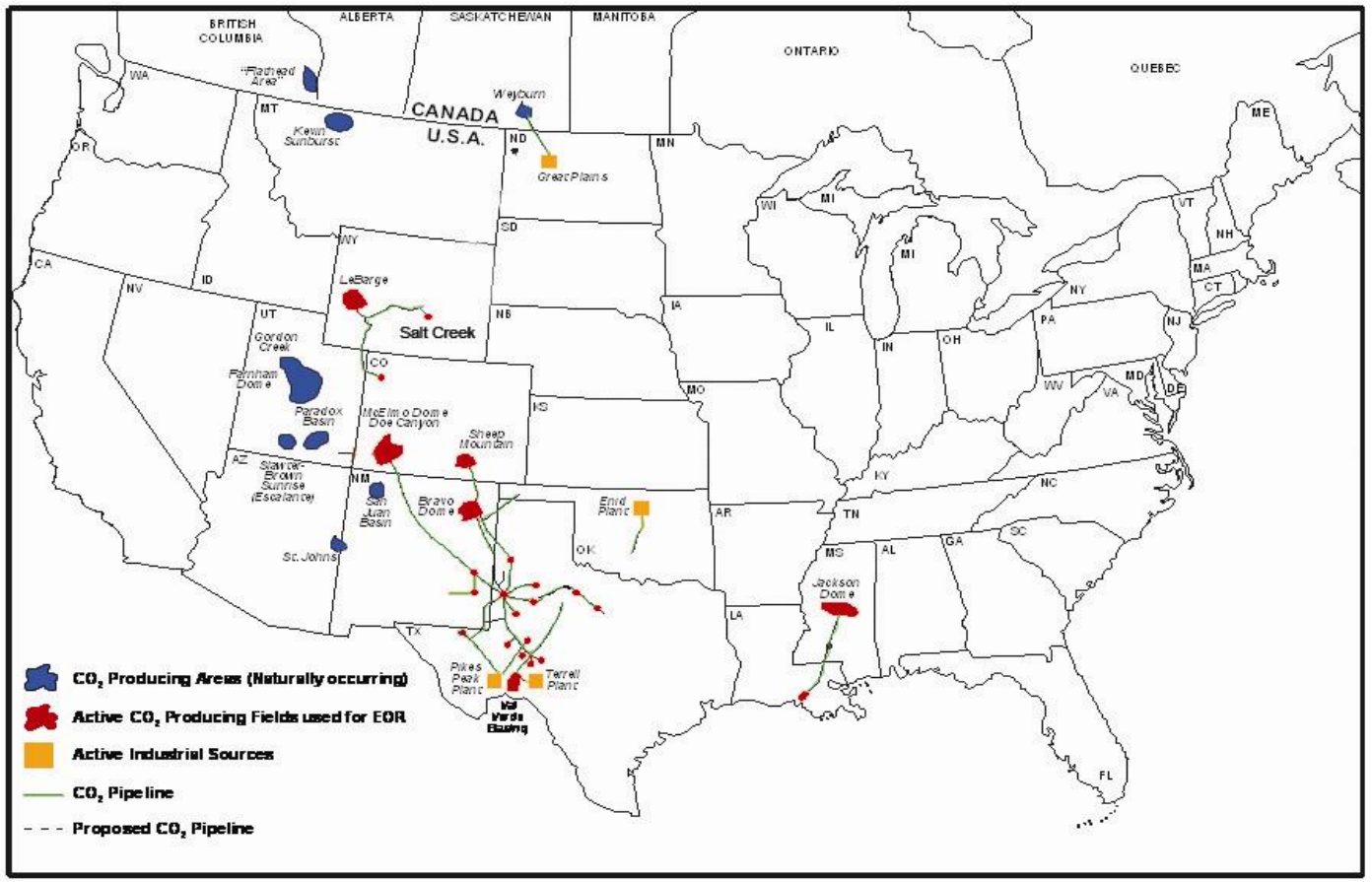
Economic and Operational Output



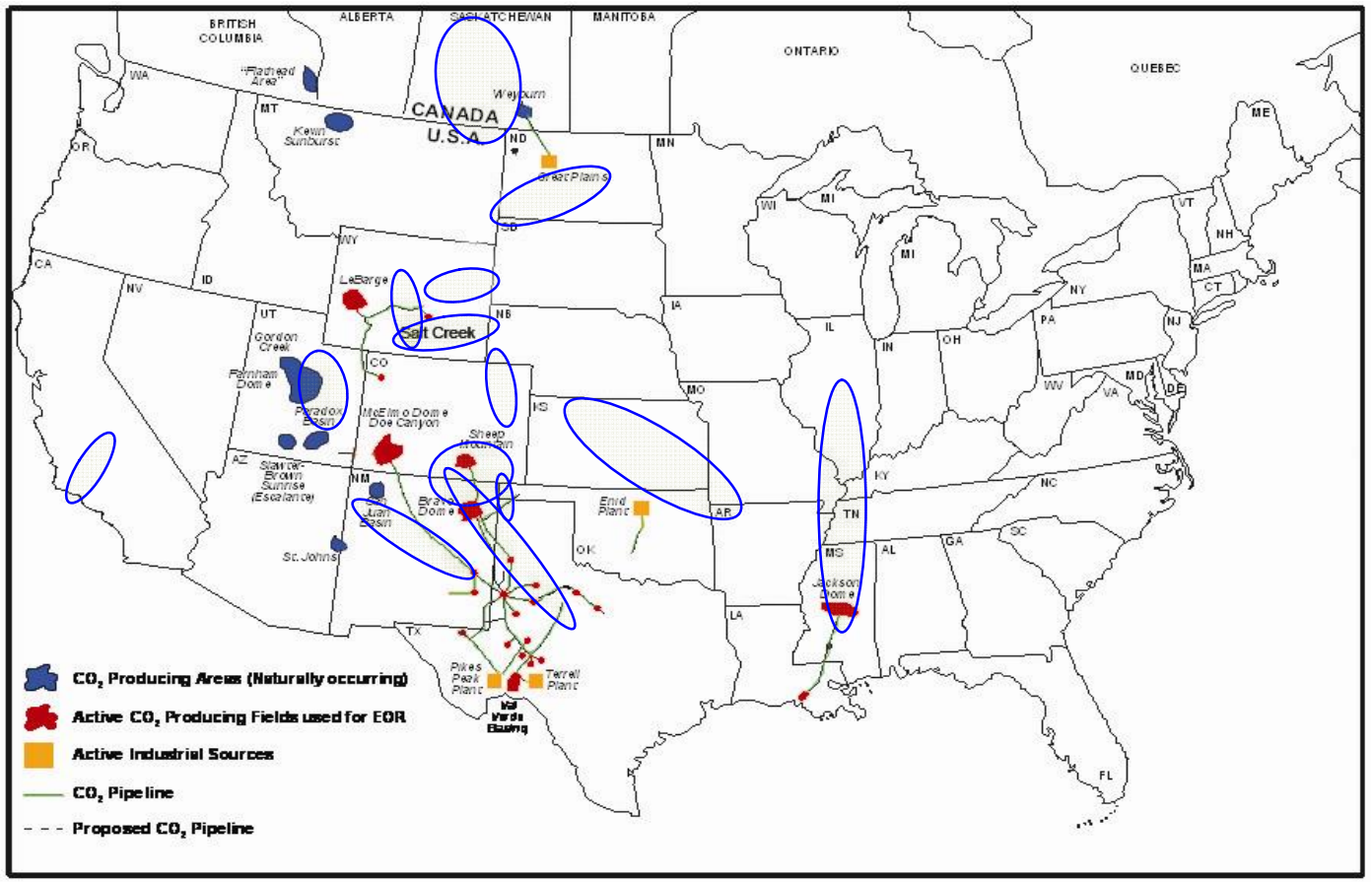




US CO_2 to EOR Sources and Sinks



Blue Project Developments “ ”



Lessons Learned in Vent Stack CO_2 Connections

- Wyoming Project
  - CO_2 demand aggregation
    - Screening buyers
    - Transparency, clear motives and representations
  - Commingling ghg VER sources
    - Consistent verifiers and protocols
    - Regional commingling
    - Flexibility in VER takes
  - Ghg VER balancing
    - Managing interruptability
    - Securing supply
    - Improving VER price
- La Veta Project
  - Dual CO_2 sources/sinks
    - Sharing the cost of vent stack CO_2
    - Reducing interruptability
  - Dual CO_2 pressures
    - Lowing cost of delivered CO_2
- Connecting the CO_2 Source and Geologic Sequestration *(Canada)*
  - Transparency
  - Advocacy of source and demand
  - Realities of both source and demand

CCS Commercial Issues

- CO_2 pipeline investment estimates
  - $40k to $50k per in diameter per mile
- Physical CO_2 commercial prices (vintage, type)
  - Retail - $3 to $12 per tonne
  - Wholesale/Reseller - $3 to $7 per tonne
  - Industrial - $2 to $10 per tonne
  - Financial - $2 to $8 per tonne
- Ghg VER commercial prices
  - Buyer types
  - US fractured and unstructured marketplace
- CO_2 pipeline risks & rewards

CCS Risk and Regulatory Issues

- Storage liability
- Pipeline common carrier status
- EOR to Saline build-out

Utah Ghg Opportunities

- Win the race of CO_2 imports/exports
- Transportation projects (pipeline and truck)
- Methane measurement and management (CMM, AMM and pipelines)
- Linkages with other states/regions
  - Ghg registries
  - Ghg carbon trading
- Utah carbon footprint
- Engage the retail industry

Blue Source at a Glance

Background Information

Not Presented

Blue Source, The Elevator Speech

Blue Source is the largest ghg VER portfolio in the world having delivered 60% of all NA transactions sourced from ghg offsets in 45 states and 40+ million tonnes presently on public NA registries. The company operates at the intersection of the energy industry and the environment. During 2006 and in combination with First Reserve, Blue Source created the largest US-based investment pool for carbon capture and storage in North America. Prior to this, the company's management build, owned and operated 4 of the 5 anthropogenic CO_2 pipelines in NA in the last 20 years. The company has long term ghg VERs sourcing agreements with CCS providers representing 85% of the marketplace. Producing 25 million tonnes each year of ghg VERs, the company's portfolio model dramatically enhances individual ghg VER supplier values. The company is positioned to lead the development of the North American carbon highway.

Blue Source at a Glance

- Overview
  - The Company's two primary US segments: a ghg VER portfolio and a physical CO_2/CH_4 project development group.
  - The Company is the largest single source of ghg VERs in North America.
  - Ghg VERs are sourced in 45 states in vintage years from 2000 to 2019.
  - The Company has approx. 45 million tonnes of ghg VERs on existing public registries in North America.
  - The Company has developed, constructed and/or operated 4 of the 5 anthropogenic CO_2 pipelines in North America in the last 20 years.
  - Blue Source is own 50/50 by its founders/senior management and First Resource Corporation, the largest private equity energy firm in the world.
  - Blue Source announced the formation of a $1 billion (equity/debt) investment source in project development for US-based ghg VERs and physical CO_2/CH_4.

Blue Source at a Glance

- Greenhouse Gas Emission Reductions Business
  - Ghg VER supplier, aggregator, portfolio and risk mitigation tools (~350 million tonnes thru 2019)
  - Completed largest number of US-based offset transactions to date
  - Transacted Non-Kyoto to Kyoto
  - Eleven types of ghg ERC offsets
  - Development of first protocols: geologic sequestration, transportation, ECM, logistics and coal bed methane
- CO_2 Business
  - Concepted and/or constructed (Val Verde CO_2 PL, North Cross CO_2 PL, Anadarko's Wyoming CO_2 PL)
    - Initially 150 MMCFD (~3 million tonnes/yr ghg VERs)
  - La Veta CO_2 PL – 2nd Qtr 2006
    - 16 miles-8 inch, initially 35 MMCFD, ~500k VERS per annum
  - Developing 9 projects (West Texas, South Texas, Wyoming, Canada)